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FURTHER NOTES ON HUMAN REMAINS FROM VERO, FLORIDA

By E. H. SELLARDS

THE human remains from Vero, Florida, the discovery of which was announced in July, 1916, have been very fully discussed, and it may seem that a further communication is unnecessary. However, in the "Symposium" on this subject which appeared in the *Journal of Geology* (Jan.-Feb., 1917) there developed considerable diversity of opinion among the geologists and anthropologists who visited the locality, some of whom accept the evidence that the human remains are of Pleistocene age as conclusive, while others are not convinced.¹ Dr. Hrdlička is of the opinion that the human remains and artifacts represent recent inclusions by burial. Dr. Chamberlin, on the other hand, although accepting the human remains and artifacts as contemporaneous with these deposits, regards the associated Pleistocene fossils as secondary, assuming that they were originally imbedded in an older deposit and were subsequently removed and washed into the deposits in which they are now found. Dr. MacCurdy regards the human remains and artifacts as normal inclusions within these deposits, but is doubtful as to the Pleistocene age of the beds. Dr. Hay regards the human remains and associated fossils as contemporaneous and is of the opinion that the deposits may be as old as middle Pleistocene. Dr. Vaughan verifies the geologic section, but withholds judgment as to the age of the human remains awaiting the accumulation of additional evidence.

A description of the geologic section at Vero and also an account of the discovery of the human bones in association with the extinct

¹"Symposium on the Age and Relations of the Fossil Human Remains found at Vero, Florida," E. H. Sellards, Rollin T. Chamberlin, Thomas Wayland Vaughan, Aleš Hrdlička, Oliver P. Hay and George Grant MacCurdy. *The Journal of Geology*, vol. XXV, 1917, pp. 1-62.

vertebrates have been given in papers previously published and hence may be omitted from this paper. Accordingly at this time it will be necessary to consider only the objections that have been offered to the conclusion that the human remains and the associated fossils are contemporaneous. It is assumed also that reference may

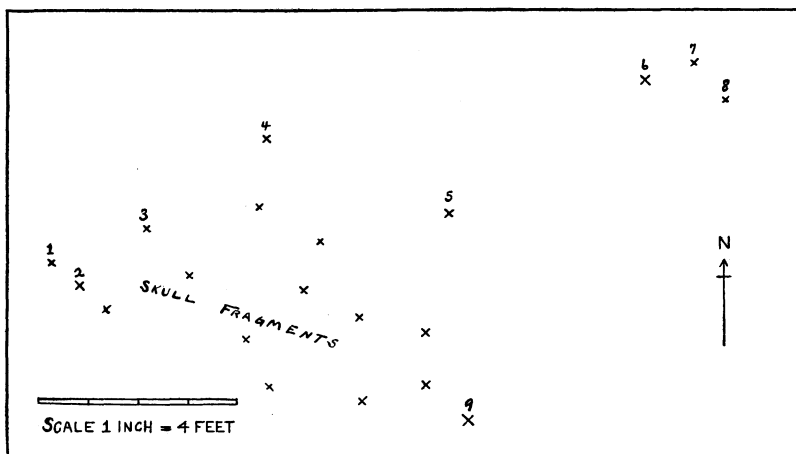


FIG. 40.—Ground plan showing the location of human bones found in the canal bank at Vero in April and in June, 1916. Index to bones; 1, left ulna; 2, a part of the shaft of the same bone; 3, left femur; 9, a part of the shaft of the same bone; 4, radius; 5, metatarsal; 6, astragalus; 7, external cuneiform; 8, part of ilium. *Courtesy of University of Chicago Press.*

be made to the earlier papers on the Vero deposits for details not included in the present paper.¹

DO THE HUMAN REMAINS AND ARTIFACTS REPRESENT BURIALS?

The question as to whether or not the human bones represent burials may perhaps be best discussed by considering the bones of the individual found in the south bank of the canal west of the lateral inlet. Of the bones of this individual, the right ulna, a part of the left humerus, a part of a scapula, one incisor, and parts of the skull had fallen from the bank. Of these bones the ulna, the humerus, and a piece of the frontal are bleached from exposure to

¹ *The American Journal of Science*, vol. 42, 1916, pp. 1-18; *Science*, vol. 44, Oct. 1916, pp. 615-617; *Eighth Annual Report of Florida State Geological Survey*, 1916, pp. 121-160, pls. 15-31; *The Journal of Geology*, *loc. cit.*

the sun. The other bones mentioned were found in cavings which had recently fallen from the bank, and do not show bleaching. All of the other bones that have been obtained at this locality were found in place in the bank. The bones which apparently may safely be attributed to this individual include, in addition to those mentioned, the left ulna (in two pieces), the shaft of the right femur (in two pieces), the proximal part of the left radius, the ascending ramus of the right lower jaw, two metatarsals, numerous fragments of the skull and some pieces of ribs. Bones found a little farther to the east which may or may not pertain to this individual include a right astragalus, a right external cuneiform, a piece from the right pubes, a part of a left ilium, two phalanges, and a section from a limb bone, as well as some other bone fragments. These last named bones are from stratum no. 2 of the section, while all of the others listed were on the contact line of nos. 2 and 3.

All of the bones are more or less broken and incomplete. The first bone found in place was the proximal part of the left ulna. An additional part of the shaft of this bone was subsequently found a few inches farther back in the bank. The second bone found in place was the proximal part of the shaft of the left femur. Two and a half months later, after the excavating had been carried back farther into the bank an additional part of the shaft of this femur was obtained, the two pieces of bone being separated in the bank by a distance of eight feet. This bone, the two pieces having been put together, is illustrated in figure 3 of plate 19 of the *Eighth Annual Report of the Florida Geological Survey*. The third bone found in place was the proximal part of the left radius. A photograph showing these three bones in place in the bank was reproduced in the *American Journal of Science*, July, 1916, and in the *Eighth Annual Report of the Florida Geological Survey*, plate 17, figure 1, and is included herewith (fig. 41). The two bones, left ulna and left radius, it may be noted, are separated by a space of five feet. The part of the radius preserved has a length of 145 mm., and hence the distance between the bones, as well as the thickness of the section, may be readily computed from the photograph. Vertically above the radius, as may be seen in the photograph, is

twelve or fourteen inches of light colored, coarse, clean sand, with which is intimately mixed a quantity of broken marine shells, this part of the deposit representing material washed from the underlying stratum (no. 1 of the section). This is followed by about ten or twelve inches of vegetable material and sand, including as may be seen in the photograph pieces of drift-wood. Above this

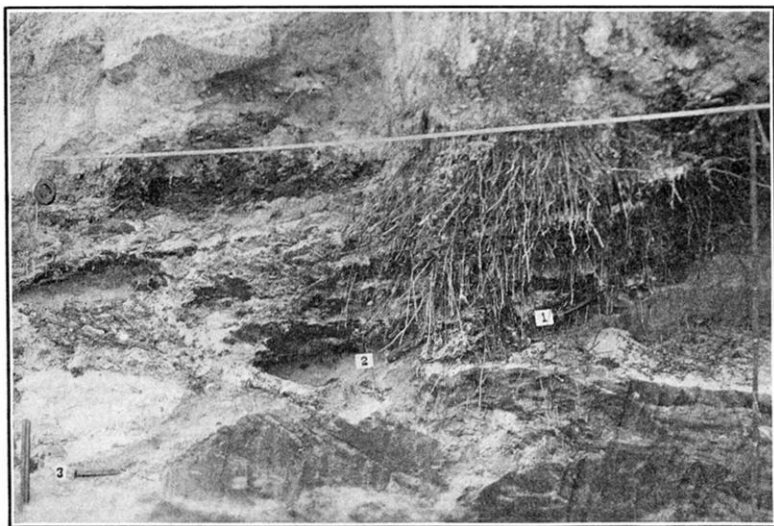


FIG. 41.—Photograph showing the ulna, femur and radius (nos. 1, 3 and 4 of fig. 39) in place in the bank. Scale of photograph, 1 inch equals about 2.2 feet. Courtesy of *American Journal of Science*.

layer is seen a lens of coarse, clean sand including some pieces of broken marine shells, all of which has been thrown in by the stream. This sand lens, as seen in the photograph, has a thickness of about six inches. Above this sand lens to the soil line is found fourteen or fifteen inches of material consisting chiefly of muck, including some sand, the depth of this bone beneath the surface being about forty-two inches. In passing to the right the deposit of sand immediately above the radius "pinched out" so that the piece of femur which lies approximately four feet farther west is immediately beneath the muck, as is also the ulna.

In the writer's description of this locality the depth is given as four feet, which is not in excess of the thickness of the deposit

overlying some of the bones. All of the bones definitely referred to this individual lie at the contact line of this deposit and the next older bed, and the varying depth of the bones beneath the surface is due to the fact that the top surface of the older deposit is irregular. The essential point involved, however, is not the depth at which the bones lie, but the fact that the deposits above the bones consist of alternating layers or strata which have not been disturbed. A sample was retained showing the sand in which the radius was imbedded, and also a sample of the sand including the broken shell vertically above the radius. This clean-washed, coarse sand together with the shell fragments, contrasting decidedly with the overlying accumulation of drift-wood and muck, affords positive evidence of stream-washed material, and conclusive proof that the deposit has not been dug into or otherwise disturbed.

The illustrations which accompany this paper include: a ground plan of the human bones found in place in the canal bank west of the lateral inlet (fig. 40); a photograph showing the ulna, femur and radius, all of which bones are broken and incomplete, in place in the bank (fig. 41); a closer view showing the succession of strata directly above the radius (fig. 43); a detailed view of the radius in place, including the sand and shell deposit immediately above it (fig. 42); and a photograph (slightly enlarged) of the sample of the sand and broken marine shells from immediately above the radius (fig. 44). These illustrations afford a record that is, it would seem, conclusive as to the conditions under which these bones were found. From the photographs it may be seen that flat objects, such as shells and shell fragments, lie prevailingly in a single plane of deposition, and that the deposits are cross-bedded, both of which features are characteristic of deposition by water. A study of the photographs and more especially of the section itself shows conclusively that these bones were washed by the waters of this stream to the place where found, and that they became entombed at the same time and in the same way as the sand, shell fragments, pieces of wood and other materials of this deposit. These bones are, therefore, unquestionably fossils of this formation and were

not subsequently introduced into the deposit by human agency or in any other way.

After the photographs were taken (figs. 41-43) excavating at this locality was continued and human bones were collected over the area indicated in the accompanying sketch (fig. 40). The manner of occurrence of the human skull is instructive. Scarcely one half of the skull was obtained, and the pieces that were secured were distributed over an area of not less than seven by three feet. The broken skull fragments fit together securely. Most of the skull pieces were found in the sand containing the broken pieces of marine shells, and it is evident that they were washed to their present resting place in the same way and at the same time as the radius and the other bones. The absence of bones and parts of bones is as instructive as the condition of the bones themselves. Of the jaw, for instance, there has been obtained only the right ascending ramus. This piece of bone is well preserved and the break shows a sharp fracture. There is no reason, therefore, to doubt but that the part of the jaw that is missing, if included within this formation at all, is also well mineralized. The same is true of the radius, of the left femur, and of the skull bones, as well as of the skeleton as a whole. From the time of the location of these bones in April, 1916, to the conference in October, 1916, the bank at this place was worked only by hand trowels and the material after being worked by the trowels was passed through screens, much of it being double screened through coarse and fine mesh. At no time were laborers allowed to work the bank with shovels or other implements. If the remainder of the jaw had been preserved within the area covered by this sketch, or in fact within a somewhat greater area, it would certainly have been recovered. The same is true of the missing and imperfect bones of the skeleton. These bones and parts of bones were either not washed into this formation, and for that reason failed of preservation, or if preserved in this deposit are lying somewhere outside of the area covered by this sketch.

It is evident that the bones of this skeleton had become thoroughly dried before they were moved and broken, this fact being indicated by the sharp fracture of the bones. Dr. Hrdlička has

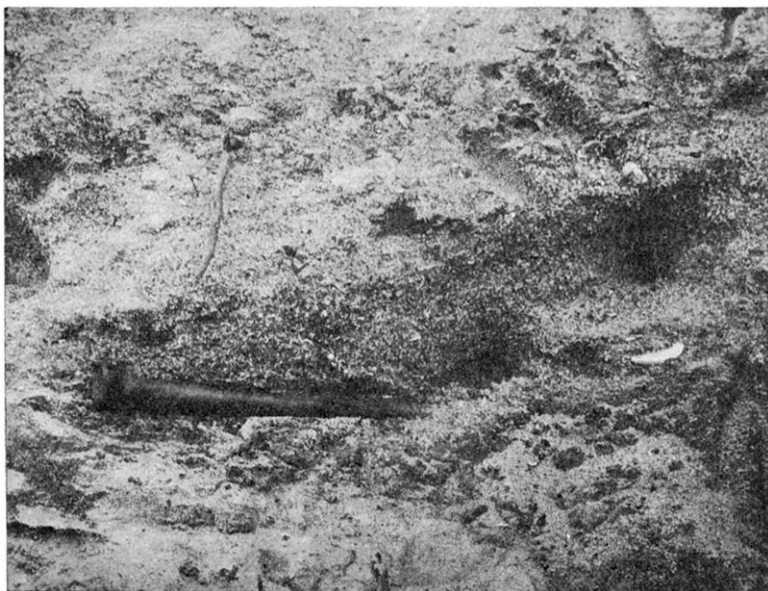


FIG. 42.—A view of the radius in place in the bank. Approximately one-third natural size.



FIG. 43.—A view showing the succession of strata above the radius.

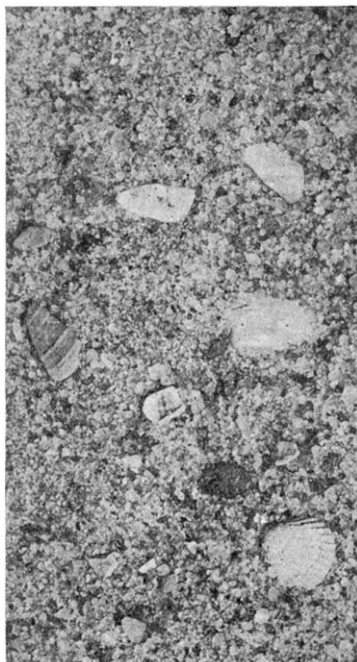


FIG. 44.—Photograph (taken in the laboratory) of a sample of the sand and shell from immediately above the radius. Slightly enlarged.

referred to the breaks in the bones as being "fresh," and suggests that the breaks may have occurred for the most part as the bones were uncovered and fell from the bank.¹ It is certain, however, that the breaks in the bones that were in place in the bank, including the left ulna, the left radius, the right femur, the left femur, the jaw and the bones of the skull, occurred at the time the bones were washed to the place where they were found. Some of the bones may have been carried much farther by the stream, while others possibly never found their way into this stream bed, thus accounting for the imperfection of the skeleton.

To assume that these bones represent a burial affords no adequate explanation of the separation of the radius and the ulna; of the displacement of the two parts of the right femur; nor of the broken and scattered condition of the skull as well as the scattering of the skeleton. On the other hand recognition of the fact that the bones were washed by the stream to their present resting place affords an explanation of every phenomenon that is presented, including: the broken condition of the bones; the separation of the radius and ulna a distance of five feet; the separation of the two pieces of the right femur a distance of eight feet; the position of the radius beneath fourteen inches of coarse sand and broken marine shells; the scattering of the parts of the skull; the presence of drift-wood in the deposit and the uninterrupted bedding above the bones, as well as the imperfect representation of the skeleton as a whole.

In all of its features this deposit maintains the characteristics of a stream fill, and we may plainly read the history of the accumulation of material at this immediate spot. The stream had cut into the marine shell marl (stratum no. 1 of the section, fig. 41), making a rather sharp trench in that formation. As the result of flood waters there was thrown into this trench an accumulation of coarse sand and broken marine shells which filled the bottom of the trench to a maximum depth of fourteen inches. Of the human bones the radius as seen in the photograph was left lying near the bottom of the trench, while a piece of the femur and the ulna as

¹ *Journal of Geology*, vol. xxv, 1917, p. 45.

well as parts of the skull were thrown well upon the side. Quiet conditions followed, interrupted occasionally by mild flood waters. One of these floods threw in the lens of coarse sand, including broken marine shells, which is seen in the photographs (figs. 41 and 43) about twenty inches above the ulna. Under these alternating conditions of quiet waters and flood waters there was accumulated the successive layers of muck and sand, with occasional inclusions of drift-wood forming the stratified deposit which permanently sealed the bones and preserved them until the present time.

The manner of occurrence of the pottery and bone implements must likewise be considered. Pottery is distributed throughout the deposit that has been designated as stratum no. 3, being more abundant, however, near the base. One hundred or more pieces of broken pottery have been taken from this formation. Bone implements are likewise general in their distribution although the greater number have been taken near the base of stratum no. 3. The large arrowhead illustrated in the *Eighth Annual Report of the Florida Geological Survey* (fig. 1, pl. 21) was found lying in a layer of light-colored, coarse sand at the base of stratum no. 3. The great abundance of pottery, bone implements and flints near the base of this deposit is accounted for in the writer's interpretation by the fact that the stream current was stronger when these first deposits were laid down than subsequently, and hence more material from the surrounding land surface was washed in than at a later time when the waters became more quiet. The muck which predominates in the upper part of the deposit belongs to the period of quiet and more or less ponded waters.

The muck of this section is followed stratigraphically by fresh-water marl, for while the marl is not everywhere present, the relative age is indicated by the fact that laterally the muck passes under and ultimately grades into the marl (*Journal of Geology, loc. cit.*, fig. 3, p. 10). The marl itself, although containing a few fresh-water shells and other fossils, represents chiefly calcareous material accumulated by chemical or bio-chemical processes. Its presence, therefore, is significant as to the probable age of the section. Hrdlička

(*loc. cit.*, p. 49) refers to the fact that this fresh-water marl when first uncovered is often soft and hardens on exposure. This, however, is true of marls in general. The Ocala limestone of early Tertiary age is frequently soft when first uncovered and invariably hardens upon exposure. The same is true of many other limestones. He notes also the fact that shells piled up by the aborigines are sometimes found to have become cemented together. It is to be borne in mind, however, that the cementing of shells artificially piled up is a materially different matter to the accumulation of a marl by natural processes.

The human bones and artifacts that have been thus far referred to in this paper are, with the exceptions mentioned, those of stratum no. 3 of the section. The somewhat older bed, stratum no. 2, likewise contains human remains, flints and bone implements. The evidence that the human remains of this older deposit, as well as those of stratum no. 3, are contemporaneous with the formation in which they are found and do not represent recent burials has been presented in an earlier paper.¹

ARE THE ASSOCIATED FOSSILS SECONDARY?

It is fully demonstrated the writer believes that the human remains and artifacts are not burials, and it thus remains to be considered whether or not the associated fossils can be secondary as suggested by Dr. Chamberlin. Dr. Chamberlin postulates that these fossils have been washed from the older Pleistocene deposits which lie immediately back of the beach through which the north and south forks of the stream cut, and refers to this formation as the "deposit which originally housed the old mammalian bones."

If the mammalian bones which are found in such abundance were washed from deposits further to the west, naturally we may expect to recover other and better fossils from the original or parent formation. Fortunately the opportunity for examining the formation in question for fossils is exceptionally good. The main canal after cutting across the beach ridge continues inland a distance of twelve miles. Moreover, the lateral which enters from the south

¹ *Journal of Geology*, vol. xxv, 1917, pp. 21-24.

continues for some miles in a general southwesterly direction. Paralleling the main canal and on the north side of it there is also a third canal which reaches inland about one eighth of a mile. The banks of these three canals which contain large masses of the particular deposit which Chamberlin regards as the source of the bones, have been carefully searched by the writer and others and no vertebrate fossils have been obtained. *It appears, therefore, that the formation from which Dr. Chamberlin would derive the bones is almost if not entirely non-fossiliferous.* In view of this fact it is to be believed that the abundance of bones found in the stream bed have washed from this formation?

In this connection the condition of the fossils themselves may be called into evidence. Both Drs. Hrdlička and Chamberlin have referred to the relative completeness of the human skeletons but there is obviously no point in this reference that will support the theories advanced by either of them. All of the human bones have been submitted by the writer to Dr. Hrdlička who states that he recognizes the presence of five individuals. One of these is represented by a single molar tooth; another by a single toe bone, while of another nothing appears to be known other than an incisor tooth. Obviously these three individuals could not have been represented by more fragmentary material. Of the two remaining individuals but an imperfect representation of the skeleton of each has been obtained, including twenty-six bones of the one and of the other scarcely so many.

Of the extinct wolf, *Canis ayersi*, thirty or more bones of a single individual have been found at one place, while near by was obtained the skull and femur probably of the same individual. The skeleton of this extinct animal is more fully represented, therefore, than is that of any one of the human skeletons. The extinct armadillo-like genus, *Chlamytherium*, is represented by a lower jaw, a bone from the skull and many dermal plates, all found at one place and probably all belonging to a single individual. The extinct stork, *Jabiru weillsi*, is represented by a humerus, part of a coracoid, part of two ulnas and two metacarpals, all found at one place and probably from one individual. Extinct turtles are represented by

all or by parts of the carapace so fragile as not to withstand secondary deposition. The mastodon is represented by a part of the skull and tusk as well as by a lower jaw and by teeth. The elephant is represented by whole teeth and by parts of the skeleton. An extinct tapir is represented by a practically complete skull. There is in fact, as the writer has heretofore stated, no essential difference either in the completeness of the skeleton, or in the manner of preservation between the human bones and those of the associated animals.

The writer maintains that these fossils, including the skulls of the tapir, wolf and mastodon, and the carapaces of the turtles, washed to the place where they were found while they were still "green," and that after being "fossilized" and thus altered to their present fragile condition would not withstand being moved by currents of water. These fossils being shown to be contemporaneous with this formation, the argument for excluding the remainder of the fauna, including skeletons in varying degrees of perfection, largely loses its force.

The fact that the human bones found at Vero indicate, on the authority of Hrdlička, that the men of that time were structurally similar to the modern Indian has been used as an argument that these human remains can indicate no great antiquity. If, however, it is true that the Crô-Magnon race of Europe of some 25,000 years ago present but few structural differences from modern Europeans, why should we doubt that the much more isolated American race may have persisted through a longer period without sensible change in structure. It has also been objected that the flints, bone implements and pottery of this deposit are of types heretofore regarded as Recent, but it has not been shown at how early a date this culture type originated.

It should not be overlooked in this connection that the marine invertebrates of the underlying deposit (stratum no. 1 of this section) had at this early time become closely similar to the modern forms. Likewise, the land and fresh-water mollusks contemporaneous with the human remains are identical with the recent species. The notable changes are found among the verte-

brates, particularly among the reptiles, birds and mammals, and include chiefly the disappearance of species, especially of the larger forms, in the extinction of which man himself may have taken an active part.

The evidence as it seems to the writer is conclusive that the human remains and vertebrate fossils found at Vero, are contemporaneous and that none of the objections that have been offered against this conclusion are valid. If it becomes necessary as a result of this discovery to recognize that the American race reached its present structural development and attained the cultural stage indicated by the artifacts of this deposit earlier than has been heretofore supposed, the conclusion is but in accord with other lines of geologic investigations which are constantly bringing to our notice larger time intervals and the earlier origin of types than had previously been assumed. To the writer the conclusion seems assured that the human remains and artifacts from the canal bank at Vero are to be referred to the Pleistocene period.

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